

SHORT COMMUNICATION

Color Variation in the Mycoheterotrophic *Yoania japonica* (Orchidaceae)KENJI SUETSUGU^{1,*} AND TAKAHIRO YAGAME²

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Due to the lack of chlorophyll, fully mycoheterotrophic plants display wide variation in pigmentation in their vegetative as well as in their floral parts. Here, we describe a creamy yellow form of *Yoania japonica* Maxim. discovered in Tateshina city, Kita-Saku-gun, Nagano Prefecture. This is another example of a mycoheterotrophic orchid that exhibits a distinct color difference from the typical form. While in the genus *Yoania*, creamy yellow coloration has been reported only in *Y. flava*, our materials are distinguishable from *Y. flava* by the morphology of the lip and petal margins (erose-serrate vs. almost entire). The ecological significance of this creamy yellow form of *Y. japonica* in the vicinity of the boundary between the distribution of *Y. japonica* and *Y. flava* is also discussed.

Key words: color variation, mycoheterotrophic plants, Orchidaceae, *Yoania japonica* f. *lutea*

Yoania Maxim. (Orchidaceae), the type of which is *Y. japonica* Maxim. (Maximowicz 1873), is defined by characteristics such as 1) complete mycoheterotrophy, 2) the lip with a large slipper-like spur, 3) four hard pollinia with a viscidium, and 4) a unique column structure (Dressler 1993, Inoue & Yukawa 2002). Although six species were originally described in *Yoania*, one, *Y. australis* Hatch from New Zealand, was been transferred to *Danhatchia* Garay & Christenson as *D. australis* (Hatch) Garay & Christenson. Another species, *Y. aberrans* Finet from Japan has been moved to *Cymbidium* Sw. as *C. aberrans* (Finet) Schltr. Among the remaining four species, including *Y. flava* K. Inoue & T. Yukawa, *Y. amagiensis* Nakai & F. Maek., *Y. prainii* King & Pantl and *Y. japonica* Maxim., *Y. prainii*, in North Vietnam and Sikkim, is unlikely to be closely related to the other three species of *Yoania*, as it has spurless flowers (Inoue & Yukawa 2002). *Yoania* is mainly distributed in Japan, but *Y. japonica*

also occurs in Assam, China and Taiwan. The three Japanese species differ from each other in several characteristics, including flower color, flower posture and rhizome form (Inoue & Yukawa 2002). Recently, we collected plants of *Y. japonica* in Tateshina city, Kita-Saku-gun, Nagano Prefecture, Japan, that have creamy yellow stems and flowers, which we describe below.

Taxonomic treatment

***Yoania japonica* Maxim. f. *lutea* Suetsugu & Yagame, forma nov.—Fig. 1**

Differing from *Yoania japonica* forma *japonica* only in the creamy yellow color of the whole shoot.

Typus. Japan, Nagano Pref., Kita-Saku-gun, Tateshina City. (Kenji Suetsugu s.n., June 22, 2012, Holotype: KYO).

Japanese name. Tateshina-shouki-ran, nov.

Distribution and Notes. *Yoania japonica* f. *lutea* is known only from the type locality. Dozens

of creamy yellow colored individuals were in an area of approximately 20 by 50 m. The area also harbor tens of normal rosy pink plants of *Y. japonica*. Nearest distance between creamy yellow and pink individuals of *Y. japonica* is less than 3 m apart. So far, creamy yellow coloration has been reported only in *Y. flava* (Inoue & Yukawa 2002). However, the creamy yellow individuals are morphologically indistinguishable from the sympatric rosy pink plants of *Y. japonica* in that the lip and petal margins are erose-serrate; the lip and petal margins of *Y. flava* are nearly entire (Inoue & Yukawa 2002). We therefore concluded that these plants are color variants of *Y. japonica* (Fig. 1).

Although *Yoania flava* has previously been misidentified as *Y. amagiensis* (Inoue & Yukawa 2002), *Y. flava* is morphologically more similar to *Y. japonica*. *Yoania flava* is restricted to the southern part of Nagano Prefecture and does not overlap with *Y. japonica* (Inoue & Yukawa 2002). It is therefore intriguing that the two color forms

occur near the boundary of their distribution areas.

Due to a lack of chlorophyll, fully mycoheterotrophic plants sometimes display wide variation in the pigmentation of vegetative parts (e.g. Fukunaga *et al.* 2008, Suetsugu 2012a, b, Tsukaya & Okada 2012) as well as floral parts, since selective pressure for photosynthetic pigments is relaxed in mycoheterotrophs. Nevertheless, coloration may still be important for attracting pollinators. The diverse array of floral coloration is often attributed to divergent selection by pollinators (e.g. Newman *et al.* 2012). It is possible that the creamy yellow morphs gain higher pollination success than rosy pink morphs within the range of *Y. flava*. Color change is often documented in deceptive orchids. For instance, *Disa ferruginea* has orange flowers in the eastern section of its range and red flowers in the western section (Johnson 1994). Newman *et al.* (2012), using artificial flowers, demonstrated that the pollinators of *Aeropetes tulbaghia* preferred both red artificial flowers and red phenotypes in the west, where the main nectar producing plant has red flowers, whereas in the east, where the main nectar plants have orange flowers, they preferred both orange artificial flowers and the orange phenotype. In another example, pale-cream flowered, rather than the usual purple-pink flowered, *Cypripedium macranthos* grows predominantly on Rebun Island (Sugiura *et al.* 2001, 2002). On Rebun Island, mutant flowers would have greater reproductive success, as there is also a high density of pale-cream flowered *Pedicularis schistostegia*. Such pale-cream flowered mutants occur throughout the Rebun populations (Sugiura *et al.* 2001, 2002). It is therefore important to determine whether the pollination system differs in pollinator species between *Y. flava* and the two forms of *Y. japonica*. Our findings may provide a model to analyze the pollination mediated speciation process in mycoheterotrophic orchids.

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FIG. 1. Flowering individual of *Yoania japonica* Maxim. f. *lutea* Suetsugu & Yagame, from type locality, 21 June 2012 (photo by Kenji Suetsugu).

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